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RADIUM

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VOL. XII NOVEMBER, 1918 No. 2

CONTENTS

Radium in War Surgery. William H. Cameron, M. D. - - - - - - - - - - 17

REVIEWS AND ABSTRACTS

A. E. Hayward Pinch, F. R. C. S. Report of the London Radium Institute, 1917. The Treatment of Arthritis Deformans with Radium Emanation Solution - - 20

Frederick C. Harrison, B. A., M. B. The Use of Radium in Post-Operative Conditions - - - - - - 21

A. Robert Taft, M. D., U. S. N. R. The Treatment of Keloid by Radium - - - - - - - - - 30

Charles A. Pfender, M. D. Roentgenotherapy in Malignant Tumors of the Parotid Salivary Gland - - 31

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A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY, PHYSICS AND THERAPEUTICS OF RADIUM AND RADIO-ACTIVE SUBSTANCES

RADIUM

A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY, PHYSICS AND THERAPEUTICS OF RADIUM AND RADIO-ACTIVE SUBSTANCES

Edited and Published by Charles H. Viol, Ph. D., and William H. Cameron, M. D. with the assistance of collaborators working in the fields of Radiochemistry, Radioactivity and Radiumtherapy.

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VOL. XII NOVEMBER, 1918 No 2

RADIUM IN WAR SURGERY *

WILLIAM H. CAMERON, M. D.

Pittsburgh

In March, 1916, I published in the JOURNAL a summary of the results obtained with radium in the treatment of backward wounds, infected and unhealed sinuses, etc., at certain military hospitals in England. The facts brought out seemed to warrant further investigation and, when in August, 1916, I received a communication from M. Barcat of France, giving a resume of his work along the same lines, I was glad to publish (1) his findings.

This work in France was considered important enough to create, by ministerial decision, a special service on radiumtherapy and now I take pleasure in having translated and published in this country a review of the results he obtained during the year 1917. The report covers results obtained in the treatment of vicious cicatrices, painful cicatrices, dermatitis, atonic wounds and fistulas.. Civil practice has amply demonstrated the value of radium in most of these conditions, therefore only that part of the report dealing with fistulas is herewith set forth.

I also wish to state that recently I have had an opportunity to observe the action of radium in the cicatrization of superficial wounds. These cases, four in number, were either old infected varicose ulcers (two) or clean indolent ulcers (two) following traumatism. All the cases had apparently resisted the ordinary methods including skin grafts, had been standing stationary for months and were located in the tense tissue over the tibia at the lower or middle third, and on the dorsal surface of the foot.

*Third communication. Reprinted from the Pennsylvania Medical Journal XXI, 579, June, 1918.

1. Pennsylvania Medical Journal, September, 1916. Reprinted in Radium, December, 1916, p. 54. Ed.

Under radium rays the cases improved in general appearance and, up to a certain point, the tracings indicated cicatrization progressing near the estimated curve, i. e., rate of healing comparable with the theoretical rate which it is estimated should occur in a particular wound under the most favorable circumstances. Later, with the exception of one case, progress was checked and in two cases slight retrogression was noted, the period of observation being about six weeks for all cases.

In analyzing our failure in these cases, as compared with the success in raying deep wounds or superficial wounds in soft tissue, it is thought that whereas in deep wounds we ray simultaneously tissue of the same density, in these cases it was necessary to ray, at one and the same time, tissue (skin) of a high resisting power and tissue (nongranulating, sloughing surface) of a very low vitality. Had these indolent wounds been located in soft tissue, this fact would not have been so important, as raying even to a point of limited necrosis would have caused no concern—would in fact be desired. However, even a second degree reaction was not permissible (this not only because of the small amount of underlying healthy, soft tissue, but because of the poor circulation in the surrounding parts) for the resulting radium burn by not responding may have caused additional disaster.

In other words, we were placed in the same position as one who attempts to ray a skin cancer of the ear with the same intensity one would employ in raying a like condition of the cheek. In the first instance deep sloughing is to be feared owing to the cartilaginous nature of the underlying structure and the difficulty in checking progressive destruction of this particular tissue. In the latter case destruction of the surrounding healthy tissue is not of great moment and is frequently aimed at in order that the rays may affect all possible cancer cell infiltration.

I am not now at liberty to give out the interesting details of these cases but trust the point I have raised will provoke discussion.

As noted above I herewith take pleasure in presenting the following translation:

A YEAR OF MILITARY RADIUM THERAPY

ADJUNCT MAJOR BARCAT

The Central Service of Radium Therapy of the ..... Region

Fistulas.—We have taken up the work of Dr. Cameron (Pennsylvania) on the radium therapy of fistulas. Cameron, early in 1916, published five cases of rapid healing (twelve to fifteen days) in rebellious fistulas in a total of seventeen cases treated by means of radium in tubes (15 to 45 mg. of radium bromid), making short applications (7 to 25 mg. hours) every second or fourth day.

Our researches have been made on forty-seven cases which have come to us after curettage had been unavailing.

These cases divide themselves into two categories: fistulas of osseous origin and fistulas of nonosseous origin.

Fistulas of osseous origin: We limited ourselves as far as possible to cases in which radiography showed no sequestrations or splinters of any size, or any foreign bodies, but a radiograph taken in a single direction does not often show even fairly large inclusions, and we have seen fistulas several times give up debris of cloth which was invisible to the rays. In Cases 4 and 5 healing was so rapid that one might ask if it was not spontaneous.

However, in thirty-seven of our cases we found there was a favor-

able modification of the secretions which from purulent became serous and much scantier. Twelve cases were healed, of which the following is a summary:

1. A fistula of the popliteal cavity of one year's standing, treated by daily injections of radioactive water, closed on the sixth day, opened on the twelfth day, and then finally closed after one month, the discharge having shown a progressive diminution.

2. A fistula in connection with a fracture of the cubitus of eight months' standing, treated by injections of radioactive water, healed in ten days after expulsion of a little splinter.

3. A fistula in connection with the calcaneum of two months' standing healed in eleven days after treatment of 120 mg. hours (10 mg. tube).

4. A fistula in connection with a fracture of the humerus, of three months' standing, healed in eight days after a dosage of 3 mg. hours (flat 5 mg. applicator).

5. A fistula in connection with a fracture of the ischium of seven months' standing, healed in three days after 10 mg. hours' dosage (10 mg. tube).

6. A fistula in connection with a fracture of the lower extremity of the radius of seven months' standing, healed in four days after dosage of 60 mg. hours (tube containing 27.45 mg. radium).

7. Fistula in connection with an osteophyte of the humerus of three months' standing, healed in three weeks after dosage of 120 mg. hours.

8. A fistula in connection with a fracture of the radius at the wrist of two months' standing, healed in three weeks following a dosage of 60 mg. hours.

9. A fistula in connection with a costal osteitis of traumatic origin of four months' standing, healed in fifteen days after a dosage of 28 mg. hours.

10. A fistula in connection with a fracture of the superior extremity of the forearm of five months' standing, healed in three weeks after 50 mg. hours, using a tube containing 27 mg. radium.

11. A fistula in connection with a fracture of the lower extremity of the humerus of four months' standing, healed in one month after dosage of 70 mg. hours and the removal of a small splinter.

12. A fistula in connection with a traumatic osteitis of the upper extremity of the fibula of three months' standing, healed in three weeks.

Fistulas of nonosseous origin: The cases naturally number less than those of the preceding category. Of the ten cases which we have obtained, however, a larger proportion of success has been obtained, as six were healed.

1. A fistula of the scrotum resulting from a suppurating traumatism of the tunica vaginalis, of three months' standing, closed after three weeks following daily injections of radioactive water.

2. A fistula resulting from a nontuberculous inguinal inflammation of seven months' standing, closed in one month after the same treatment.

3. A fistula of the thorax following an operation for empyema and of six months' standing, closed in a month after daily injections of radioactive water.

4. A fistula of the thorax following a purulent traumatic pleurisy closed three weeks after the application of a tube for a total of 240 mg. hours (27.8 mg. radium in tube).

5. A fistula following a nontuberculous inguinal adenitis of three months' standing, closed in three weeks after a dosage of 320 mg. hours.

6. A fistula of the thorax following a purulent pleurisy which healed in fifteen days following a dosage of 274 mg. hours.

The four cases in which treatment was not a success were:

1. A fistula following an operation on a hydatid cyst.
2. A fistula following a tuberculous inguinal adenitis.
3. A fistula following a wound in the thigh caused by projectile with no osseous lesion but which in the course of treatment gave up cloth debris revealing the cause of its rebellious nature.
4. A stercoral fistula.

CONCLUSION

We can see by what has preceded the interest which radiotherapy presents in military medicine, mainly as concerns the treatment of vicious cicatrices, painful cicatrices, dermatitis, atonic wounds and fistulas.

REVIEWS AND ABSTRACTS

A. E. Hayward Pinch, F. R. C. S., Report of the London Radium Institute, 1917: The Treatment of Arthritis Deformans with Radium Emanation Solution.

ARTHRITIS DEFORMANS. The daily administration of 250 cc. of radium emanation solution of a strength not less than 1 millicurie, *i. e.*, 2,670,000 mache' units per litre, to patients suffering from this obstinate, painful and crippling disease, is sometimes attended by very remarkable results, though exactly how these results are produced is still a matter for conjecture. The research work which has so far been accomplished, however, shows that the re-inforcing of the body ferments, the increase of tissue oxidation and metabolic processes generally, and the dissolving of uric acid are factors which contribute largely to its success.

The cases which appear to derive most benefit are those in which the disease is of comparatively short duration, and the changes periarticular in type, and multiarticular in distribution, occurring in patients under 40 years of age. Monarticular traumatic athritis is not so much benefited, and no improvement is to be looked for when cartilaginous or osseous changes are predominant, and bony ankylosis exists. In the most favorable cases the effect of a six or twelve weeks' course of treatment will often keep the patient free from any active manifestation of the disease for a period of a year or longer; in others treatment may have to be repeated every three or four months, and some cases are on record in which the patients have undergone a six weekly course three or four times a year for a period of five years, and this procedure has kept the disease in abeyance, and has enabled them to perform their daily work in comparative comfort.

Arthritis Deformans. Case No. 1486, M., aged 27. This patient was first seen in September, 1914, the disease having then existed for nine months. When examined many joints were found to be affected. There was great swelling of the metacarpo-phalangeal joints of the first

and second fingers, and of all the proximal interphalangeal joints of the fingers of both hands, with slight inter-osseal wasting, and some ulnar deviation. Both wrists were swollen and stiff, both elbows were much swollen, the right elbow joint could not be extended beyond an angle of 165°, nor the left beyond 155°. There was great limitation of all movements of the shoulder joints. The hips were unaffected. Both knees were very stiff, the metatarso-phalangeal joints of both great toes were enlarged and painful, and tenderness was elicited on pressure over all the other metasarso-phalangeal joints. The patient was much crippled. He could not dress himself, button his collar, nor tie his shoe laces, and was only able to walk for a very short distance with the aid of two sticks.

He received twelve weeks' course of radium emanation solution during the months of September, October, November, 1914. Great improvement resulted, and by the following spring he was so much improved that he could walk for a mile and a half with comfort without sticks, and was able to dress himself completely, with the exception of putting on his coat.

Arthritis Deformans. Case No. 5084, F., aged 47. This patient had suffered from severe arthritis of the right hip joint for many years, the pain being so constant and so extreme in degree that she was unable to sleep for more than half an hour at a time. All forms of treatment had proved futile. She received a twelve weeks' course of radium emanation solution during October, November, and December, 1911. By the end of December all pain had disappeared, and the patient could perform with ease movements which she had been quite unable to accomplish for many years.

She has since suffered from occasional slight recrudescences of her complaint, but they have always yielded promptly to a further course of radium emanation solution.

When last seen in January, 1918, she was entirely free of her trouble, and could walk four or five miles with ease.

Arthritis Deformans. Case No. 5194, M., aged 54. This patient came for treatment in May, 1912, suffering from severe arthritis of the left knee and hip which had existed for eighteen months, and had proved very intractable.

When examined, the movements of the left knee and hip joint were found to be much restricted, painful, and accompanied by some grating. The wasting of the left thigh muscles was very pronounced. The patient could walk only for a short distance and with great difficulty.

He received a twelve weeks' course of radium emanation solution during May, June, and July, 1912. Great and rapid improvement followed, and by the end of September, 1912, all movements of the affected joints were free and painless. The thigh muscles had regained their tone, and the patient was able to walk three or four miles with ease.

There has been no recurrence of the trouble, and when the patient last reported in January, 1918, he was in excellent health.

* * * * *

Frederick C. Harrison, B. A., M. B., (Toronto, Canada). The Use of Radium in Post-Operative Conditions. The International Journal of Surgery, Vol. 30, No. 4, pp. 98-103, April 1917.

"During the past ten or twelve years the therapeutic value of radium has been proved in a great variety of pathological conditions. Beginning with the first clinical work in the treatment of superficial skin lesions,

particularly the rodent ulcer, carried out at the Paris Radium Institute, the field has been gradually widened and extended, so that in many clinics and in all countries radium therapy has come to occupy a distinctive place for itself."

"At first, as we have stated, its use was restricted to the more superficial conditions. Dermatology offered a particularly attractive field for experimentation with the newly discovered agent. It was found to be of distinct value in the treatment of a large number of hitherto very intractable disorders. Port-wine stains, nevi, angiomata, keratoses, chronic eczemas, keloids and cutaneous epitheliomata were very responsive to the action of the radium. Its action in skin cancer naturally led to its use in other malignant conditions, where suitable circumstances presented themselves. Obviously the first cases met with were those in which all other customary and tried measures had proved unavailing. Inoperable cases of cancer of the breast, cancer of the uterus, sarcomata, etc., were referred to the radium clinic as a *dernier* resort, and with, in many instances, most gratifying results. That is to say, in a very fair percentage of such hopeless cases favorable changes, both local and general, occurred, resulting in an amelioration of such distressing symptoms as pain, hemorrhage, offensive discharge, with the healing of ulcerations and a distinct retardation in the spread of the malignant process. The best observers were if anything ultra-conservative and hesitated to pronounce definite "cures." However, as time passed, it was evident that in certain cases one was justified in speaking of a cure, the disease having to all appearances disappeared for a sufficiently long period."

"Such otherwise hopeless patients having been so much benefited, occasional reports began to appear where, as the method of choice, radiumtherapy was employed in the treatment of malignant growths. For superficial malignant lesions radium soon established itself as in every way the most desirable method of treatment on account of its ease of application without discomfort and inconvenience to the patient, and because of the excellent cosmetic results which were obtained. For deeper seated disease the greatest caution had to be exercised in order not to discredit the method before the profession. Over-zealous enthusiasts occasionally attempted the obviously impossible, receiving in consequence the censure of more sober thinking physicians and only causing the pendulum to swing so far the other way that, particularly among the surgeons, the use of radium was somewhat discredited. This period, however, soon passed over as it became more recognized that it had a tremendous power for good when applied in the proper direction. More particularly was it established that, far from being antagonistic to the surgeon's art, it was a most valuable adjunct, and offered the possibility of securing better permanent results in the surgery of malignant disease. Thus in many cases by a proper use of radium inoperable conditions could be so improved as to render it possible to perform a satisfactory operative procedure for the removal of a new growth; in other instances small localized recurrences after operation could be completely removed by a judicious use of this agent; in still other cases its use as a prophylactic against recurrences of the disease was found to be a most deciding factor in their prevention. This post-operative use of radium is now regarded by authorities the world over as a most important phase of radium therapeutics. It is this particular phase that we wish to discuss in this paper. Any personal observations recorded have been made in the prac-

tice of Dr. W. H. B. Aikins, of Toronto, during the past seven years that he has been using radium."

"One may briefly indicate the physics and methods of application of radium. As used in therapeutics, one of its salts, usually the bromide or sulphate, is employed. The changes produced depend upon the energy given off by the salt in the form of rays, which are of three kinds, called the alpha, beta and gamma rays. The alpha rays are really positively charged atoms, material particles, about twice the size of a molecule of hydrogen. They form about 90 per cent. of the total radiation, and are projected with a velocity of about twenty thousand miles per second, but as they have very little penetrating power, being easily stopped by a thin piece of paper or rubber, they do not ordinarily have much therapeutic value. The beta rays are negatively charged particles, projected with the velocity of light. They are almost identical with the cathode rays liberated in a vacuum tube. About 5 per cent. of the radiation is formed by these rays, which vary in their penetration, so that various gradations from "soft" to "hard" beta rays are encountered. The gamma rays form about 5 per cent. of the whole radiation, but they have great penetrating power. They will traverse quite readily as much as ten centimeters of lead. Their velocity is that of light, and they are a pulsation of the ether, being similar to the x-ray, from which, however, they differ in their far greater penetrative power."

"By interposing screens of aluminum or brass of varying thicknesses the passage of different rays can be prevented, so that only the desired kind of radiation may be allowed to pass and exercise its therapeutic effect."

"As supplied by the manufacturers radium apparatus is in two forms, the flat applicator and the tube. In the former the radium salt is spread out on a flat surface, and gives out its rays only in the one direction. For applying to large surfaces this is the best type of applicator. In the latter, 10, 25, 50 or more milligrammes of radium are enclosed in a platinum tube, which can be inserted directly into a tumor mass or into the various body cavities."

"No absolutely satisfactory method of estimating the dosage of radium has as yet been determined. Many observers use the milligram-hour method, as suggested by Dr. Dawson Turner, while others prefer simply to state that they have used an applicator containing so much radium for a certain period of time."

"The effects produced by exposure to the radium rays can be demonstrated histologically in the tissues so treated. In a study made by Aikins and Simon, (1) the following conclusions were drawn: In carcinomata: (1) The cells gradually diminish in size and staining properties. (2) This atrophy corresponds not to the metamorphosis of these definite formed elements, but to their destruction, as shown by keratinization or absorption. (3) The epitheliomatous cells disappear either by means of progressive absorption of protoplasm and nuclei through the leucocytic infiltration or by a sort of granular degeneration. The other processes associated with the development of every epithelial tumor are arrested, while vascular connective tissue is organized. (4) As proof that the changes initiated by radium in the tumors are such as to lead to immunity, great importance must be attached to the cellular infiltrations, first leucocytic, then later a round-celled. It has been recently shown that these require different reactions of the tissue for their function,

hence radium must affect the blood. These infiltrations have always been noted in all cases of experimental transplantation of malignant cells, and always accompany the cases in which the animal becomes immune and the tumor disintegrated."

"In sarcomata, retrogression takes place according to the following laws: (1) The size of the body and of the nucleus of the large cells decreases. (2) As they shrink the neoplastic elements elongate, the shape of the nucleus becomes regular, and they eventually assume the form of large embryonic connective tissue cells, forming into a celled mass similar to that of a true fibroma. Thus we may emphasize the fact that sarcomata are transformed by radium into a tissue analogous to that of a fibroma with myxomatous changes."

"Bearing these facts in mind it will be readily appreciated how logical are the reasons which led to the employment of radium as a post-operative measure after the surgical treatment of malignant new-growths. The penetrating power of the rays influences any cancer cells which have perhaps been left beyond the margin of the dissection, producing in them the retrograde changes just enumerated; while the possibility of a blood immunity to malignancy being occasioned by the use of radium should be borne in mind, difficult as it may be to thoroughly establish it."

"Discussing post-operative conditions more in detail, cancer of the skin may be first considered. The basal-celled epithelioma or rodent ulcer responds so satisfactorily to the action of radium alone that operative measures are seldom necessary for its treatment. Occasionally to expedite matters the thick beaded edge may be curetted, after which the application of radium soon results in healing with very little and hardly noticeable scarring. The squamous-celled epithelioma may also frequently be treated by means of radium alone, but if the growth appears to have invaded the subcutaneous tissues an excision of the mass followed by subsequent raying of the part is to be preferred. Such was the treatment adopted in the case of a colleague who was referred to Dr. W. H. B. Aikins over three years ago for an epithelioma on the right cheek just below the eye. A small portion removed for examination showed invasion of the subcutaneous structures by the cancer cells; consequently an excision was done, with subsequent radiation of the part. There has been absolutely no indication of return of the disease, either locally or in the glands of the neck, where metastasis might have been anticipated."

"In epithelioma of the lip it has been found possible by a judicious combination of surgery and radiumtherapy to secure excellent results without causing the great disfigurement often occasioned by a wide excision of the mass. Not only should the affected area itself be radiated but the lymphatic channels draining from that area may with advantage also receive prophylactic radiation against the formation of metastases. As a case in point one may refer to a man fifty-five years of age, referred to Dr. Aikins in August, 1914, for an epithelioma of the lower lip, which had appeared three years before and been allowed to progress until, when first seen, almost the whole of the red surface of the lower lip was involved, presenting a central ulceration surrounded by a hard rolled edge. This was curetted, a heavy exposure to radium was given over the whole of the lower lip, complete healing subsequently taking place. There has since been no evidence of recurrence of the disease."

"An interesting case of epithelioma involving the nasal fossa may be recorded, which occurred in the practice of the late Dr. Price-Brown of

Toronto. A growth had developed on the outer wall of the right nasal fossa, which on excision and examination proved to be a squamous-celled epithelioma. Following excision the base had been cauterized, but the growth recurred and several cauterizations had been done before the patient was referred to Dr. Aikins for radium treatment. "Cross-fire" radiation obtained by placing one placque externally, with another smaller one inside the nostril against the involved area—the total dosage being 100 milligram-hours—resulted in a disappearance of the recurrence, and there has been no further development during five years."

"Cancer of the buccal, lingual and pharyngeal mucous membrane is perhaps the most difficult of all manifestations of malignancy to respond to treatment Excision where practicable should be done in every case. This, followed by heavy post-operative radiation, has given good results in some cases of personal observation of which the following will serve as examples:"

"A patient, fifty-two years of age, was seen in October, 1913. She had an epithelioma inside the left cheek, following irritation from a tooth. The treatment advised was excision followed by post-operative radiation. The operation was performed by her local surgeon, who sent her back in two weeks' time for radiation. At the site of the operation a soft epithelial proliferation had already taken place, but there was no ulceration. By means of an apparatus held inside the mouth against the part and a placque fastened externally on the cheek heavy radiation of the part was given. When seen two months later, the mass which had been present had quite disappeared. All that could be detected of the presence of the growth was the scar at the site of operation. As such a length of time has elapsed one can reasonably regard the case as cured, the five-year interval hardly being necessary in such rapidly recurring growths as those of the buccal mucosa."

"A man, fifty-three years of age, complained of a growth which he had noticed on the floor of his mouth for about two months. On examination a mass was found, clinically epitheliomatous, involving the frenum and the floor of the mouth. There were no enlarged glands to be detected. The mass was excised, examination proving it to be a squamous-celled epithelioma, and as soon as the sutures were removed a post-operative radiation was given of 130 milligram-hours. Three months and a half later there was no evidence of any return of the disease inside the mouth, but an enlarged gland was detected on the left side of the neck. This was radiated. It was over ten months before anything further was seen of this patient, at which time the gland was found to have completely disappeared. At the site of the former growth was a thickening which aroused suspicion of recurrence, but this completely disappeared after the further application of radium."

"Dr. Robert Abbe (2) of New York has reported a similar case of epithelioma of the frenum of the tongue, which after excision and radium application remained well after five years."

"Another very satisfactory case was that of a man, aged fifty, who had an epithelioma involving the anterior portion of the palate, extending through into the nasal fossæ. As much of this mass as could be was dissected out, and subsequently very heavy radiation was carried out both in the mouth and in the nasal fossæ. The improvement was wonderful. The excision had been so incomplete that immediate recurrence of the growth was looked for by his surgeon; instead the parts became clean and have gradually healed over. There is no offensive odor to nasal di-

struction, and apart from the perforation through the palate, he has completely recovered."

"Cancer occurring primarily in the glands of the neck should be treated by excision of the involved area with strong post-operative radiation. It frequently happens that in this situation, owing to the firm attachment of the growth to important blood-vessels or nerves, it is impossible to obtain a clean dissection of the cancerous mass. The post-operative use of radium finds in such cases a field peculiarly its own. Such a case is reported by Abbe, in which there was a carcinoma at the root of the neck which had grown so tightly to the carotid artery that complete dissection was impossible. Immediate post-operative use of strong radium for eight hours has resulted in immunity from disease for four years."

"In the treatment of cancer of the breast the proper procedure is to operate when possible, and follow with radiation of the parts to prevent recurrence. This combined treatment is not new, as isolated observers have been advising it for some years. In 1911, Nahmmacher (3) in a paper on "Radium and Cancer," discussed the value of radium in operable cancer as a secondary treatment after operation. He referred to the fact that radium rays have an elective action on any cancerous tissue which has been left after operation, and that owing to their greater penetration they are more effective, besides being painless and giving a better cosmetic result, than the x-ray. He believes his results in cancer of the breast are better than other observers because of his practice of using radium in this post-operative manner."

"Burnam (4), also, in speaking of the use of radium in cancer of the breast, states that operable cases should have the combined treatment."

"The writer can add his personal observations to those of other authorities in support of this combined treatment for breast carcinoma. There can be no doubt from the patients treated in this way in the practice of Dr. Aikins that recurrences have been far less numerous than one would ordinarily look for. As a case in point may be mentioned a patient who nearly five years ago had a recurrence of cancer in the right axilla following amputation of the breast twelve years previously. It was found impossible to dissect the mass out entirely. She was immediately subjected to heavy post-operative radiation of the axilla. There has been no recurrence of the disease. Three years ago, carcinoma developed in the left breast. This was removed and the axillary glands of that side were found to be carcinomatous. Post-operative radiation carried out in the axilla and over the area of operation on that side has resulted in complete freedom from recurrence."

"Another patient seen four years ago had carcinoma of the right breast, which had been removed three months before. Examination of the axillary glands revealed carcinoma cells present. As a prophylactic, her brother, a physician, wished her to have post-operative radiation, which accordingly was carried out. The result has been most gratifying, for whereas recurrence was looked for in view of the pathological findings, the patient has been quite free from any sign of return of the disease."

"Within the scope of the title of this paper would also come those cases where small nodules develop along the line of suture after amputation of the breast. Radium treatment is here most effective in causing disappearance of the masses without recourse to further surgical procedures."

"A patient, thirty-six years of age, had had the left breast removed for carcinoma in October, 1914. In May, 1915, she noticed some areas of thickening along the lower end of the line of incision. There were four separate nodules, each about as large as a split pea. Exposure of these points to 120 milligram-hours of radium treatment resulted in their complete disappearance."

"When we come to consider carcinoma of the abdominal viscera, as distinct from disease of the pelvic organs, which will be considered more fully, the results are somewhat meager. In carcinoma of the stomach or liver, Burnam (4) states that he has seen no definite cures, but that "it would seem that an intelligent combination of surgical and radiation treatment might lead to a very great improvement in the present methods of treatment." He also states that ascites due to abdominal cancer is occasionally completely done away with by radiation."

"Cancer of the rectum when inoperable offers a particularly favorable field for the use of radium, and many observers report good results. Those cases in which an operation has been performed should receive post-operative radiation, no matter how completely the growth may have been removed. Frequently, of course, only a partial operation is feasible, and in such cases radium has a wonderful influence in diminishing the unremoved portion of the growth. Chase (5) reports a case in which an adenocarcinoma was removed from the posterior rectal wall, leaving, however, an area of infiltration extending for one-half the circumference of the gut. He radiated, using "cross-fire" action, and in six weeks' time no evidence of diseased tissue could be found. He says: The use of radium after the removal of a malignant growth is of great importance to reach any remaining malignant tissue that in many cases one cannot identify."

"Cancer of the uterus has, with the exception of the cutaneous epitheliomata, received more attention from the radium therapeutist than any other pathological condition, and a large amount of literature has accumulated during the past few years bearing on this particular problem. As we are concerned only with the post-operative use of radium there is no occasion to go fully into the indications for its application in cancer of the uterus. In inoperable cases there is universal evidence that the improvement following its use is remarkable. Pain is relieved, hemorrhage and discharge arrested, and a shrinkage and fibrosis take place in the growth to such an extent that operation can subsequently be performed where previously it was contra-indicated. A few observers even go so far as to say that radiumtherapy should be the method of choice in the treatment of the disease. To this opinion we would not care to subscribe; but that a judicious combination of surgery and radiumtherapy is the proper procedure to be adopted in a large number of such cases is supported by reliable authorities."

"Wickham and Degrais (6) believed that where complete excision was impossible, partial removal of the growth followed by applications of radium was the ideal procedure. They observed disappearance of cancer nodules, relief of pain, cessation of hemorrhage and fetid discharge, and disintegration of the cancer cells in the deeper parts of the malignant growth."

"Abbe (2) has had several advanced cases treated by curettage and radium, which have remained without recurrence for three or four years."

"Degrais (7) has more recently stated that after several years' ex-

perience with radium treatment he regards it as a most valuable aid to surgery, applied after curetting or partial or total extirpation, while Labre (8) in a similar paper emphasizes the importance of radiumtherapy in tending to complete the surgical procedure and ward off recurrence."

"Henry Schmitz (9) in an exhaustive article on the use of radium in uterine cancer, states that prophylactic raying after operations to prevent recurrences is recommended by all workers in the field. He quotes Gauss who reported 21 such cases, of which 20 remained free from recurrence up to six years after operation, while usually sixty per cent. of the cases not receiving post-operative radiumtherapy show recurrences within the first year."

"Concluding a paper on radium achievements and speaking of uterine cancer, Howard Kelly (10) advises radiation after operation, where the latter is feasible."

"The technic in treating uterine cases is deserving of consideration. It is desirable to use only the more penetrating rays, which have been shown histologically to exert their effect to a depth of three and a half inches. The irritating and destructive action of the softer rays is to be avoided, for extensive sloughing might otherwise occur. The radium is contained in platinum capsules and further screened by being encased in rubber, and is applied to the cervix or into the body of the uterus as the case may be. Authorities differ as to the dosage to be given. Some advocate long exposures to a large quantity of radium, but there is no doubt that very unpleasant toxic reactions frequently develop after such heavy dosing. An exposure of from 600 to 750 milligram-hours, repeated at intervals of four to six weeks, has been found to give good clinical results."

"As examples the following cases may be reported:

"In 1911 a patient was referred to Dr. Aikins suffering from cancer of the cervix. Operation had been refused by one surgeon who gave her six weeks to live. A second surgeon curetted, but gave no better prognosis. On the bare chance of relieving her to some extent, radium was used. The results were most gratifying. She had previously had frequent hemorrhages, but these ceased after the first application. She put on weight and was able to resume her usual duties. Locally a marked fibrosis was produced. Unfortunately, five years later a metastastis developed in the liver, which proved fatal. The patient in the meantime had enjoyed five years of life, which in view of the hopeless state she was in when first seen we regarded as directly due to the radium treatment she had received."

"A patient suffering from cancer of the body of the uterus was referred in March, 1915. A hysterectomy was to be done, but on opening the abdomen her surgeon found such an extension of disease into the left broad ligament that he thought it was wiser not to proceed. He cauterized the uterine cavity and cervix, and sent her to Dr. Aikins for radium treatment. This has been carried out at intervals of six weeks, and up to the present there has been no evidence of activity of the disease."

"In the treatment of cancer of the vagina or vulva post-operative radiation also plays a valuable role, and should always be carried out. The writer has seen two such cases where the results obtained were excellent."

"The first was a woman of twenty-nine, who, four years ago, had a carcinoma of the vulva excised. Following the operation there was a de-

velopment about the scar of a very suspicious area of induration. She was therefore referred for radiation two months later. The response to radium applied over the whole of the involved area and also over the inguinal glands was most satisfactory; the thickening subsided, and there has never since been any sign of recurrence of the disease."

"The second patient was an elderly woman of nearly eighty, who had an epithelioma of the right labium. The growth was excised, and also the inguinal glands on the right side. She was referred and received prophylactic radiation. Six months later the glands in the left groin, where no radiations had been given, began to enlarge. They were excised and showed metastatic deposits of a squamous-celled carcinoma. Radiation given subsequent to the operation resulted in freedom from recurrence of the metastasis, which in view of the extensive glandular involvement found at the time of operation was regarded as highly satisfactory."

"So far we have considered only epithelial new-growths, but the beneficial results from radium apply also to the sarcomata, and in treating many such cases the combined use of radium and surgery is particularly effective. It frequently happens that an incomplete operation is all that can be performed in the removal of a sarcomatous mass. The introduction of radium tubes into the wound, with external application to produce a "cross-fire" action, is most valuable in such a condition and should never be omitted."

"Certain types of sarcoma cells are more readily influenced by the radium rays than others; the small round-celled sarcoma and the lymphosarcoma responding more readily. It is claimed by Morson (11) that if growing from tissues other than bone the spindle-celled sarcomata respond as readily as do the round-celled."

"Certainly the results obtained in the following cases, which may be taken as examples, strongly support the opinion just pronounced."

"In an infant a few weeks old, a spindle-celled sarcoma developed at the side of the anus. Two operations had been performed, but the mass immediately recurred. Following the application of radium over the wound, complete healing resulted. There has been no recurrence in over six years."

"A gentleman, sixty-one years of age, had had two operations for the removal of a sarcoma which had developed just below the angle of the jaw on the right side. A third operation was performed in London, England, in 1910, and a week later he received heavy radium treatment from the late Dr. Wickham in Paris. He was referred to Dr. Aikins by Dr. Wickham for further prophylactic radiation. This was carried out, and at no time since has there been any return of the growth."

"A patient, female, had had a round-celled sarcoma removed from the left jaw; the growth involved the antrum and complete dissection was not possible. Post-operative radiation was given by means of radium in tubes, passed into the antrum. There has been no recurrence in over eighteen months."

"A female patient, twenty years of age, was seen first in January, 1916. There was a growth on the inner aspect of the right arm of six months' duration. A skiagraph revealed a fusiform mass apparently involving the shaft of the humerous. The diagnosis was sarcoma, and amputation at the shoulder was advised. On further consultation it was decided to excise the mass and then radiate. At the operation a mass attached to the bone, but not involving it, was removed. Examination showed it to be a round celled sarcoma. Radium tubes were inserted

directly into the wound down to the bone, while placques were applied externally. The wound healed perfectly, the patient made an uneventful recovery, and there has not been any evidence whatever after over a year's time of recurrence of the growth."

"From the clinical evidence one has received in the study of such cases, and many others which it is unnecessary to note in detail, the importance of post-operative radiation is more and more impressed upon one. Nor should there be any undue delay in carrying out such procedure. In some cases radium is applied directly after operation. In other cases it may be desirable to allow an interval of a few days to elapse, but to wait until there is some sign of recurrence before consulting the radium therapeutist is to be unequivocally condemned. Many authorities, to some of whom reference has already been made, emphasize strongly the importance of early post-operative radiation. There is no doubt that surgeons, too, are becoming more strongly convinced of the necessity of this extra safeguard in the treatment of their cases of malignancy. To quote Wickham and Degrais (12): Can radium aid surgery in the treatment of malignant tumors? Our answer is wholly affirmative. Most assuredly radium can give valuable aid to surgery in the treatment of malignant tumors. Immediate operation is recommended in all operable cases, raying the area afterwards to completely extirpate the last cells of the growth."

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A. Robert Taft, M. D., U. S. N. R., (Charleston, S. C.) The Treatment of Keloid by Radium. The Urologic and Cutaneous Review, XXII, 31-32, Jan., 1918.

"Keloid, or, as it is spelled more properly and less frequently, cheloid, has been doubtfully treated for many years. And it is only in the last decade, with the discovery of the roentgen ray and radium and the better understanding of their physics and consequently their possibilities, that the treatment has been at all satisfactory."

"This condition is so prone to attack the negro, and we in the South see so many cases in this race and so few in the whites, that I am afraid that some of us are inclined almost to believe it confined to this people. I see many arising on the sites of old scars. Knife wounds, boring of ears, burns particularly, small-pox scars, etc. Their position in the social

scale, their indifference to this disfigurement, the painless tumor and the expense of the treatment, account for few reports of cases treated with radium."

"Of course keloid is fibroid tissue arising in a scar, and in these days when we are hearing so much of the treatment of fibroid of the uterus with the x-ray, we might look toward the use of this in treating keloid. This is, I am sure, of great value and I have treated several cases with much success. The reports of failures with this reported in the books are cases treated some years ago before the day of filtration and the cross fire with the x-ray. Probably the hard beta rays and the gamma rays are the same. We see advocates of treating ankylosis of joints resulting from war wounds by these remedies, with equal enthusiasm. The radium being however particularly rich in gamma rays would theoretically anyway be especially indicated and Dr. Aikens says in this condition radium may be considered almost a specific."

"In the treatment of keloid as in the treatment of naevus, we desire as perfect a cosmetic effect as possible and every care should be taken to secure it. Unscreened radium would be prone, by producing secondary destruction and scar, to set up a much greater growth, and unless our radium is covered with chamois, rubber or some such second filter when using brass or lead filter to prevent passage of any except the hardest beta and the gamma rays the secondary rays or rays of Sagnac may cause telangiectases."

"The first of the two cases shown was a white woman of about 45 years. She had spilt some very hot water just over the upper part of the sternum, a favorite place for keloid. She was treated with radium every few weeks for several months and at the expiration of that time the tumor had entirely disappeared. The second case shown is little colored girl of about ten years from the Roper Hospital outdoor clinic of The S. C. Med. Col. She has a keloid on the cartilage in front of the ear about three-quarters of an inch long, half-inch wide and half-inch thick. This started on the site of a small wound received from a sharp stick while playing. It grew to some size and was then cut out by a surgeon. Almost immediately it commenced to return and its growth has been rapid since. Under use of radium the tumor has grown rapidly smaller. At present it is only about one-quarter of the first size and will doubtless be gone in a short time. I have seen few of these multiple growths and am loath to accept the infectious theory advocated so many years ago and which I believe is again gaining some ground."

"The two methods mentioned in books on this subject, are to use heavy screening and by the cross fire method give all gamma rays possible without affecting skin. The other is by unscreened radium to produce destruction of growth. This latter method it would seem very unwise to use, as much inflammatory tissue and scar would arise and the growth be apt to return in a greater degree. The screened method is now, I believe, used by all operators."

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Charles A. Pfender, M. D., (Washington, D. C.) Roentgenotherapy in Malignant Tumors of the Parotid Salivary Gland. Medicine and Surgery, Vol. 1, No. 4, June, 1917, pp. 300-375.

"In looking through the literature of malignant tumors of the parotid classified in the Index-Catalogue of the Library of the Surgeon General of the Army, I encountered 3 case reports of malignant tumors of the

parotid gland based on successful treatment with radium. The results reported are so conclusive that a brief abstract of these cases may be justified."

"In 1911, (Ann. Surg., 1911, Vol. LIV, p. 230) Abbe presented before the New York Surgical Society, a man, who five years ago was on the point of giving up his profession as a lawyer, owing to a parotid tumor the size of a goose egg cut lengthwise, which raised the ear and filled the parotid fossa. Treatment consisted of the insertion into the tumor of tubes of radium. Its rapid reduction and diminished size had been sustained by occasional treatments at long intervals, with the result that there remained now an inert mass. Portions of the tumor had been punched out prior to the insertion of the radium tubes and had been reported to show all the qualities of parotid sarcoma excepting cartilage."

"Berard (Lyon Med., 1914, CXXIII, pp. 18-21) in Lyon, France, reported an instructive case in 1914. Female, thirty-three years old, admitted to hospital, September 25th, 1913. In January, 1913, she suffered from severe odontalgia and she noted an enlargement in the parotid region at that time, which gradually subsided. In September the entire parotid region enlarged again and caused considerable pain. The condition was at last diagnosed as actinomycosis. Treatment with iodine for eight days brought no relief, on the contrary the symptoms were aggravated suggesting the presence of a chrondro-sarcoma; the induration was already so extensive that the condition was considered inoperable. Patient was referred to Moutet for radium treatment. Radium was applied four times at intervals from October 7th, 1913, to January 6th, 1914, with complete recovery. Microscopical examination of pieces of tissue punched out of tumor mass showed typical epitheliomal nests."

"The only other case of tumor of the parotid treated by radium that I have encountered is reported by Weil (Jour. Am. Med. Assoc., 1915, LXV, pp. 2138-2140) in 1915. Female, thirty-six years old, parotid tumor of seven years' duration. Treated for six weeks by insertion of radium into tumor. Tumor disappeared entirely and no sign of recurrence at time of report two years later. Microscopic examination of specimen showed it to be "adenoid cystic epithelioma" of parotid."

"I take pleasure in citing these 3 cases in connection with my own work for the reason that all 3 cases were held inoperable by competent progressive surgeons, and, what is more important, all three were completely cured by radium alone."

"The literature does not abound with case reports of malignant tumors of the salivary parotid gland treated either by radium or roentgen rays, for the simple reason that few men have had opportunity to employ radium on account of its expense, while roentgentherapy, until quite recently, had not perfected a technique which was sufficiently powerful in its results to destroy the tumor mass without injury to the patient."

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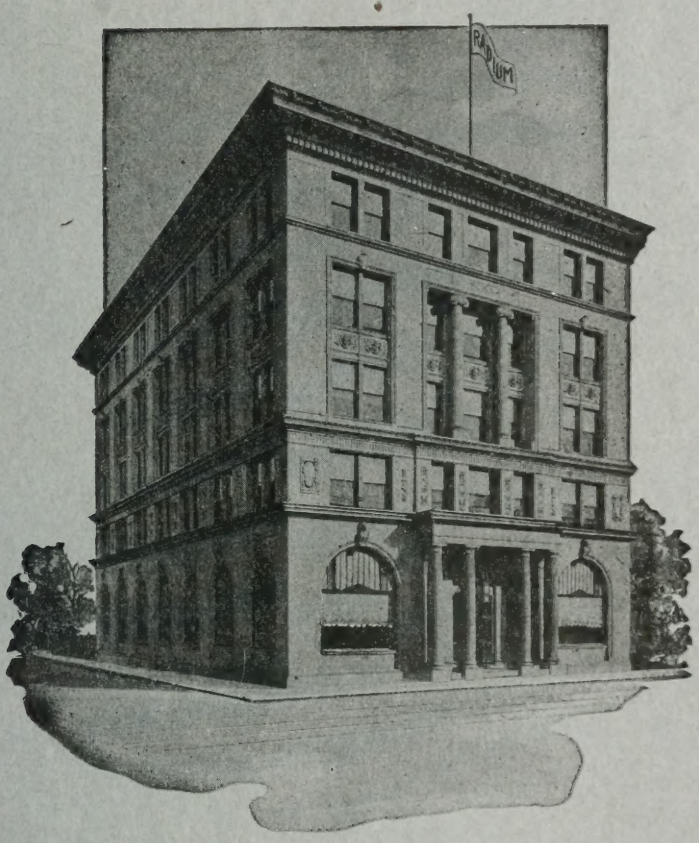

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